9DEC1969

Research and Engineering Division

Program Narratives

I. Accomplishments. TSSG/RED accomplishments are generally covered within the RD&E program submission and as such will not be reiterated here. There are, however, a number of accomplishments related to the in-house activities of the Reconnaissance Systems Branch and the Exploratory Laboratory of the Advanced Technology Branch--integral elements of the Research & Engineering Division--which are not covered in this submission. These accomplishments are as follows:

A. Reconnaissance Systems Branch

1. The Reconnaissance Systems Branch developed a short time pad, or camera exposure burst, technique in support of NRO/SOC. This technique provided the intelligence community with 24% more targets acquired per [redacted] mission-- at no increase in cost. 25X1

2. The Branch provided full-time participation in a CIA effort related to the planning for the development and exploitation of a [redacted] system. 25X1

3. Branch personnel developed a quick-reaction method of determining the correct positions of missed targets for use in subsequent acquisition programs. Utilizing this system, the number of targets missed has been radically reduced.

4. "Standing Prerequisites for the Exploitation of Collection Systems", a definitive specification was prepared and distributed.

5. The Branch supplied, to operations at [redacted] detailed requirements for future [redacted] emphemerides such as the MCD. 25X1 25X1

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6. RSB completed guideline studies regarding sun angle/exposure requirements that have provided superior vehicle programming operations.

25X1 7. A preliminary [redacted] manual was written and distributed to the community.

8. The Reconnaissance Systems Branch succeeded in establishing 25X1 NPIC [redacted] altitude requirements through COMIREX for implementation by the NRO.

B. Exploratory Laboratory.

1. The Laboratory has demonstrated a system of ultraviolet radiation and special photoprocessing which can be utilized to monitor potential sources of unauthorized disclosure of classified information. Our laboratory experiments with these techniques proved that reconnaissance film, with the photographic emulsion stripped off, still retained latent classified information capable of being reconstituted by special techniques. This was also true of standard viewgraph backing materials. The need was demonstrated for controlled disposal of these wastes to ensure tight security.

2. Equipment to establish a photometric standard was successfully designed and built in order to achieve a consistent measure of light table brightness. Copies of this instrument are calibrated by the Exploratory Laboratory and then supplied as GFE to vendors for determining if light tables conform to procurement specifications.

3. In-house experimentation proved that a technique for directly viewing an original negative as a positive image--suggested by a contractor--was totally unsuitable for NPIC requirements. This knowledge terminated consideration of 25X1 a [redacted] R&D program to develop a prototype.

4. An exploratory experiment indicated that for image detail of less than 50 microns in size, Dual Gamma and Trenton processing both produce the same mensuration results. This had been an area of considerable speculation.

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5. Sixty-seven individual grid patterns of four different geometries were produced in support of the [redacted] Stereo-comparitor Project. These high-precision units serve to calibrate the optical components of this equipment and will be utilized in its acceptance checks. 25X1

6. Laboratory derived knowledge provided APSD with factual data on the use of matte particles in aerial films. Exploratory Laboratory produced photomicrographs of microtomed film slices gave additional insight into the problem created by particle interference when reconnaissance imagery is viewed under very high magnifications.

II. Program Plans.

A. Statement of DDI Objectives. Develop equipment and techniques to improve the efficiency of imagery exploitation.

B. Statement of NPIC Objectives.

1. Research, Development & Engineering Management Support.

a. Provide research, development, and engineering support to the Center's imagery exploitation effort and to the other elements of the imagery exploitation community to the extent of the Center's capability.

b. Maintain a laboratory staff and facility that undertakes research in the photosciences and identifies new areas for development and engineering.

c. Provide technical coordination and liaison with the developers of new acquisition systems and provide the Center's operational components with information on the nature and impact of future reconnaissance systems upon Center operations.

d. Promote coordinated equipment procurement programs as a means of cost-savings.

e. Apply an R&D project management system which establishes an effective means of needs analysis, contractor selection, project justification, and monitoring.

C. Discussion of Objectives.

1. Requirements. In addition to the obvious requirement for the development of appropriate technology to support current operations, the systematic and efficient exploitation of a broadening spectrum of reconnaissance imagery dictates the continuing development of an extensive family of advanced equipments, materials, and techniques keyed to the specific handling requirements imposed by the collection systems themselves. NPIC attempts, through the Reconnaissance Systems Branch, to maintain an awareness of, and a responsiveness to, the exploitation implications contained in the imagery from progressively more advanced and diverse acquisition systems. Because of the complex technology involved, NPIC often must become an integral part of the system development team during its early stages. At the same time, we are in a unique position to evaluate and predict the impact and effectiveness of technical changes occurring in reconnaissance technology. Thus, NPIC's research and development must not only accommodate current and impending changes in the imagery inputs to the Center, but must also provide the means to "feed back" to imagery suppliers those objective data and analyses which will tend to upgrade both the quality of the product and the efficiency of the subsequent imagery exploitation process.

Under NSCID 8 and the National Tasking Plan, NPIC has an additional responsibility to provide research and development support to, and to promote joint procurement programs with, other members of the intelligence community currently engaged in National-level imagery exploitation. Because these members work with the same collection products, it is expected that this requirement can be met without the creation of additional programs. Through the mechanism of the Exploitation Research and Development Subcommittee of COMIREX (EXRAND), these efforts are thoroughly discussed and appropriately scaled to specific community needs before they are permitted to become candidates for Center implemen25X1

D. Method of Approach. Primarily because of over-all funding limitation, NPIC has, in the past, found it necessary to emphasize short-range, quick-pay-off projects at the general expense of longer range programs which would have provided a more systematic approach to the development of new exploitation systems, equipment, materials, and techniques, while at the same time, advancing the over-all state-of-the-art. This approach has generally been able to provide the Center with essential exploitation equipments, while at the same time, providing reasonable economy. This approach worked for three primary reasons; first, the earlier acquisition systems, while state-of-the-art, were not overly sophisticated by today's standards; second, there was so much initial work to be done--so many items of equipment of known parameters which had to be developed; and third, the Center was in a period of somewhat unrestricted growth--when a difficult problem arose, more manpower was applied.

The situation has changed; the new acquisition systems are highly sophisticated and are becoming more so; most basic equipments of known parameters have been built; and the Center now has fixed personnel resources. With this change in situation, it appears realistic that our RD&E approach also change.

We are now entering an era in which there will be inputs from a growing number of extremely complex acquisition systems. This era will require a corresponding broad systems approach to the development of exploitation equipment. With this over-all increase in sophistication, the technical unknowns will rapidly expand producing corresponding increases in the technical risks and the development costs involved. In order to minimize these technical risks and reduce development costs to acceptable levels, NPIC must develop a very systematic and pragmatic approach. First, we must judiciously establish a broad technological foundation based upon a sound research program consisting of prudent studies and selected feasibility breadboarding. We must, at the earliest possible moment in the development cycle,

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isolate the component areas of maximum technical risk and establish solutions prior to implementing total systems which may still contain fundamental weaknesses. We must establish multiple-phased programs with prudent milestones and numerous key check points, while at the same time providing an effective R&D management system designed to make maximum utilization of these tools. This is both a methodical and practical approach; however, it is both time-consuming and expensive; nevertheless, in the long run, it will ultimately prove to be cheaper.

Our FY-72/76 R&D projection is based upon anticipated needs in individual program categories. There are assumptions made which may, or may not, prove valid later on. However, the over-all approach is to develop a balanced program with some effort directed toward each category, using the best judgements and estimates now available, and subsequently, scaling the total R&D program to a reasonable level.

Stemming from efforts currently underway, an integrated exploitation system will have evolved early in the FY-72/76 period which will provide a foundation for subsequent research and development concepts. Data from the PI Process Research and Image Analysis and Manipulation programs, for example, will be readily available to locate and define the most significant areas requiring future research and development and will provide specific performance requirements. By the middle or end of this period, automated assistance will be available from the Imagery Interpretation Instruments and Techniques program to provide a significant part of the administrative and collateral information required for exploitation processing on a near-real-time basis. This will include image quality manipulation and evaluation, automatic target location, automatic target changes, current correlated colateral data, and analysis of existing and new data inputs by the interpreter. During the latter half of the planning period, equipment will be developed for appropriate utilization of various forms of unconventional and restored imagery and near-real-time reporting, which will, in

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ovide the technical basis for integrating and absorbing into Center operation any radically different imagery inputs from a near-real-time collection system, which is expected to have considerable impact on the utilization of imagery for intelligence purposes.

E. Alternatives Considered.

a. One obvious alternative is a continuation of research and development at about our current levels. Conservatively, if we specify one or more of the newly-emphasized, major program areas as being beyond NPIC's compass, and if the National-level exploitation effort is willing to pick up the slack, significant increments could be taken out of the Agency budget picture altogether.

At the other extreme, it would be quite possible to project that the total research and development effort in imagery exploitation--directed toward strategic purposes--could be put under NPIC's direction. This would appear counter-productive, however, in that NPIC does not have either the physical base nor the total operational perspective necessary to perform all the work for all potential users.

Another alternative is that we could encourage a climate in which NPIC's research and development depends to some extent on outside funding, DOD, [redacted] ACDA, etc. This course has the advantage of centralizing talent and resources, but in a practical sense, it requires both initiative and cooperation on the part of other agencies above and beyond contemporary expectations. It may be that by utilizing a system approach, rather than a project-oriented approach, we can make this a practical proposition, inasmuch as direct project control then becomes an unimportant aspect as long as the definition of the final objective is mutual among the sponsors.

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b. Risks Involved. NPIC has of necessity begun a transition away from the emphasis on "short-term, quick pay-off" projects; since, this "short-term" approach cannot be pursued indefinitely. Most of the obvious projects have been investigated or developed, and while such projects will always have a high priority, we can readily foresee that we can no longer obtain significant major technical accomplishments without first establishing significant preliminary groundwork. The effect of this change will be to reduce risks over the long haul at a relatively modest increase in cost, and perhaps more important, to allow for the insurance of eventual success in over-all programs which are built up of numerous, individual, small projects which are, in themselves, inherently risky.

F. Coordination. NPIC will continue to conduct coordination of research and development activities in accordance with established Agency procedures, and through the mechanism of EXRAND, which provides a unique focal point for exchanges of information. There will be no lessening of the coordinating and up-dating activity NPIC pursues through the dissemination of equipment catalogs and R&D News Notes.

G. Resources Required. In line with the increased level of technology to be developed within the planning period and with changes in the technical areas of emphasis, it will be necessary to expand our technical resources in certain critical areas,

25X1 such as [redacted] electronics, and computer technology. The extent to which this will take place will be a direct function of NPIC involvement in future collection systems such

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During the five-year period, a higher level of research and development funds will be needed to pay the costs of phased development contracts with private industry and for other service contracts applicable to modification of equipment on hand, to provide individual consulting services, and for satisfying immediate operational needs.

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TSSG

PROGRAM NARRATIVES

Management Support

Objective - Office of the Chief

The Office of the Chief, TSSG will participate in development and coordination of NPIC plans, procedures, and techniques for the efficient exploitation of new and existing collection systems. This will include determining, in concert with representatives of other members of the intelligence community, future research and development needs. Related efforts also will be undertaken to reduce community research, development, and procurement costs by direct and thorough exchanges of information. **Provides Chairman for EXRAND.**

Objectives - Special Contract and Procurement Staff

a. To solicit proposals, negotiate, administer, and settle R&D contracts in a timely manner and in accordance with good procurement practices.

b. To provide advice and guidance to DD/I elements, and to other Agency elements as applicable, in R&D procurement matters.

c. The Chief, SC&PS, as a member of the Agency Procurement Policy Panel, to represent the interests of the DD/I elements in the consideration of new procurement policies and procedures.

d. To undertake appropriate training in furtherance of performance of Staff mission.

Resources Required

The addition of one GS-12 Contract Specialist to the SC&PS is foreseen for an increase in volume of R&D procurements.

Objectives - Projects and Programs Staff

a. Support the Chief, TSSG by performing analyses of requirements, programs, budgets, and procedures related to TSSG operations.

Objectives - Projects and Programs Staff (Cont'd)

b. Control Group production, providing representative to NPIC Production Management Board, establishing relevant procedures, and maintaining necessary records.

c. Support EXRAND, supplying Executive Secretary and performing all necessary typing and clerical duties.

d. Prepare annual catalog of imagery exploitation equipment for community-wide dissemination.

5 December 1969

MANAGEMENT SUPPORT

SUPPORT SERVICES DIVISION NARRATIVE

A. Accomplishments:

Approximately 3,000 square feet of space formerly a part of the film library has been converted into an ADP area to accommodate Fastrand equipment which will be used in support of the Integrated Information System. The film library space available for this use was a part of the overall space gain which resulted from the installation of mechanized FULLSPACE filing equipment in the film library.

Equipment procurement was begun by the Office of Communications on the Center's behalf toward the installation of a new secure voice system. The new system, which is estimated for completion in FY-1971, will greatly expand the Center's present secure voice capability and will interface with the CIA Green phone system as well as AUTOSEVOCOM.

The Center became a participant in the silver recovery field with the installation of a system which claims silver from hypo solution by an electrolytic process. In addition, the Center has purchased equipment which will permit the recovery of silver from film emulsion. This system will become operational upon completion of the expansion of our so-called incinerator/SOMAT area.

Significant strides have been taken during the past year toward improving and expanding parking facilities for NPIC personnel. Increasing numbers of incidents involving personal harassment and threats and theft and vandalism of automobiles prompted such action.

A new approach to the recruitment, training, utilization and retention of NPIC professional employees was initiated during the year with the adoption of the concept of the Imagery Intelligence Officer (IIO). This concept calls for the rotation of personnel through a variety of assignments as their careers progress thus allowing for broader development and wider utilization of individuals in more senior positions. Our professional recruitment efforts are now being centered on those young people who have the education, interest, aptitude and flexibility necessary to learn the many facets of imagery intelligence.

The Center is currently in the process of automating its personnel records to provide NPIC management with timely, accurate personnel information. The automation process will be accomplished in two phases. Initially, there will be a manual input of the complete position control register into the NPIC computer system. By batch processing methods, the file will be manually updated and, on request, will provide information such as number of positions, number of incumbents, number of PI's, average grade of mathematicians. The second phase will be to put the program into an on-line system with instant input-output. At that time the program will be enlarged to include personal data on employees which could either be analyzed on an individual basis or by category. For example, the education of Mr. "X" could be reported by itself or in relation to all others in Mr. "X's" age group, occupational series or career service.

B. Program Plans:

(1) Objectives -

GENERAL: Provide efficient services in the areas of personnel, security, logistics, training, finance and records management support.

SPECIFIC: Requirements recently levied on the Training Branch plus those which are envisaged for the FY 72-76 period are worthy of special note here.

This Branch has been charged with developing and implementing an IIO Training Program and a NPIC Career Development Program. Among other features these programs will provide for rotational assignments within the Center and to other Agency components. To be effective, the programs will require close supervision and strong management.

The Training Branch must also be expected to support and eventually implement the several training packages presently under development by the [redacted] will participate.

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Finally, the Training Branch must address itself to the matter of providing systematic equipment training programs for Center personnel. This would require the development and conduct of such programs for all new equipment delivered to the Center. Although it is expected that most of the new equipment now in development will be delivered to the Center by the end of FY-73, equipment training requirements will continue into the indefinite future.

Constantly increasing training requirements demand a personnel increase.

(2) Resources Required -

With the foregoing additional requirements added to the responsibilities with which the Training Branch is presently charged, it is apparent that some relief in the form of additional personnel is in order. It should beremembered that in addition to handling the usual internal/external training programs, the Branch administers an active student cooperative program (which is still expanding), manages the so-called on-site training program and assumes responsibility for scheduling Center orientation tours and briefings (and, in fact, conducts many of the latter).

In inter-Group discussions on the subject of equipment training programs, it has been generally agreed that two full time instructors will be required for such programs with one having primary responsibility for interpretation equipment and the other for photogrammetric equipment. These two positions should be programmed for FY-1971.

In addition, the Branch believes two additional professional training officers are required to meet all other training demands. Of these two officers, one is needed immediately. The crucial need for the second individual will be somewhat dependent on the timing of training programs suggested by the [redacted] studies. 25X1

TSSG/ESD FIVE-YEAR PLAN, FY 1972-1976 PROGRAM NARRATIVES

These narratives are based upon the objective pertaining to equipment test, evaluation and maintenance given under the Imagery Services program element. The given objective has been revised and two new objectives have been added.

FY 1972-1976 FIVE YEAR PLAN

Objective (revised):

Perform the evaluation and testing of equipment/systems acquired or to be acquired by NPIC to ensure suitability and performance before introduction into the NPIC equipment inventory; perform preventive and emergency maintenance of equipment/systems to ensure good operational performance.

Accomplishments:

The Test and Evaluation Branch was taxed to its maximum capabilities during FY-1969 due to a high ratio of projects to test engineers. One co-op student was added to our full-time complement of four test engineers and branch chief. Because of the absence of industrial engineering resources, these same engineers were pressed into the study of industrial engineering problems on an emergency basis such as, the effect of building vibrations on viewing and mensuration, the analysis of operational procedures and the collection of quantitative data on use of equipment. A review of accomplishments shows that 10 test plans were prepared, 12 T&E reports were completed, 49 man-days were spent on trips to contractors plants and 31 man-days were devoted to formal training attendance. Five prototypes were found unacceptable for operational use and returned to the Research and Engineering Division for further development, thereby preventing unsuitable equipment from entering the Center's inventory. In addition, the branch has contributed to the preparation of specifications for future equipment, to proposal evaluations and to the TICOF program.

Thus far in FY-70, the Branch has 4 final T&E reports in production and is working on 4 test projects. In addition, the first phase of a building-wide vibration survey has been completed and results reported. At present considerable effort is being devoted to a study leading to the procurement of instrumentation for measuring the color rendering properties of light tables.

Significant progress was made toward the goal of centralized maintenance. An Instruction was drafted and coordinated with publication expected by the end of the calendar year. Partial implementation of the centralized maintenance concept thus far has resulted in a better understanding of overall maintenance needs, recognition of costs and resources involved and more effective management of the function. A recognized responsible office served to reduce confusion and to eliminate some duplication of effort at least in the requirements planning area.

During the past year from 1 January to 30 November 1969, the Equipment Performance Branch received and responded to 666 requests for miscellaneous emergency services of which approximately 51% were electronic, 35% mechanical, and 14% optical. The requests by operational

components were:

COMPONENT	REQUESTS	PERCENTAGE OF TOTAL
PSG	232	35
IEG	216	32.5
DIA	113	17
IAS	68	10
TSSG	21	2.5
ARMY	16	3
		100%

Under the Preventive Maintenance program, a total of 1726 instruments were serviced. This included cleaning, repairing, lubrication, alignment and replacement of missing or malfunctioning parts. Minor modifications were made as required.

During the past year, 39 new remote stations were connected on-line to the Univac Computers. The remote equipment includes Teletype Printers, Kleinschmidt Printers, CRT Display Units and various types of mensuration instruments. As of 1 December 1969, there is a total of 65 remote on-line stations in [redacted] Fifteen additional stations ar25X1heduled for connection during December.

Requirements and Authorities:

The purpose of the objective is to test and evaluate equipment/systems to ensure that they are acceptable and suitable for use in the Center and to ensure compatibility with existing systems and equipment prior to and at the time of introduction into the NPIC inventory to prevent an accumulation of unsuitable, untried or unused equipment.

The purpose of the maintenance engineering program is to keep in-service, existing equipment/systems in prime operating condition with minimum equipment downtime and in a condition of peak performance. It has been found that proper maintenance and repair is far less expensive than short cycle replacement of unserviceable equipment with new equipment of the same model. As equipment increases in complexity this cost differential increases exponentially.

The test and evaluation program was established and justified on the basis of an Inspector General report, which cited a finding that newly developed/acquired equipment entered the Center inventory with little control and minimal objective analysis of capabilities.

Method of Approach:

The preventive and emergency maintenance program has been established with primary emphasis on a responsive in-house capability to provide emergency maintenance immediately as needed and to treat preventive maintenance on a routine basis. To supplement current

in-house capability, some contractual maintenance is planned, primarily for preventive maintenance where immediate response is not a factor.

The test and evaluation program has also been established with primary emphasis on an in-house capability justified on the fact that uncertain equipment delivery dates, the risk associated with R&D projects, and the necessity for intimate knowledge of intended use requires a flexible, responsive capability. Contractual support will be required but only where it can be applied with minimum risk, i.e. in the development of standard test procedures, methods, techniques and instrumentation.

Alternatives Considered:

The alternatives considered for both programs were to provide both capabilities totally through contractual support. Decreased response time, degree of inflexibility, risk associated with industrial support in time of crises, cost of in-house versus contract support were factors considered in arriving at the stated approach. Also not to be overlooked, is the fact that contractual support requires in-house technically qualified contract monitors to assure that the government gets full value for its expenditures.

Coordination:

Both programs are coordinated closely with the R&D program and the operational components' equipment procurement plans to forecast maintenance and T&E requirements.

Resources Required:

In order to provide in-house support for the equipment/systems planned for future use in NPIC, additional resources will be required. Resource estimates are given elsewhere in the Plan.

Objective (new):

Perform equipment/system modification design engineering, fabrication and installation of improvements required to ensure maximum effectiveness of existing, in-service, equipment/systems. This is an additional objective closely related to the equipment test, evaluation and maintenance objective under Imagery Services.

Accomplishments:

During FY 1969, a total of 150 modification, design and fabrication tasks were completed in support of Center components. The projects included special type eyepiece adapters for microstereoscopes, precision mounts for optical bench carriers and electronic modifications on instruments for on-line use to the computer. These were electronic, mechanical and optical in nature and combinations of the three. Most of these projects were identified through informal discussions with equipment operators about inadequacies in equipment performance.

Requirements and Authorities:

Equipment modifications are required periodically to improve in-service equipment or to correct deficiencies discovered during operation. Since the equipment is essential to NPIC operations, this work is in direct support to the Imagery Analysis and Imagery Services Program Elements.

Method of Approach:

The majority of equipment modification will be accomplished in-house using existing and planned resources of man-power, equipment and work-space. Modification work beyond the capability of these resources will be covered contractually. Major modifications requiring extensive engineering, research and development efforts to change or add to the functions of existing equipment will be referred to the R&D program.

Alternatives Considered:

Increased use of contractual support, increased in-house staffing and elimination of the requirement were considered. While increased contractual effort is an acceptable alternative, a certain amount of in-house capability is required to provide prompt responsive action and to develop and maintain the necessary expertise to apply in emergency situations. As long as the exploitation processes use equipment, the requirement cannot be eliminated, voiding the third alternative. With severe limitation on in-house staffing, an in-house/contractual mix is selected.

Coordination:

Modification efforts involve the components engaged in imagery analysis, imagery services and RD&E and actions proposed to be undertaken are coordinated with those components. Based upon past experience, it is expected that some future requirements will be initiated by them.

Resources Required:

Modification work will continue in the immediate future within the limits of current manpower restrictions. Increased requirements are expected in the planning period due to the advanced nature of the equipment/systems scheduled for installation together with an overall increase in the quantity of equipment to be used in the exploitation process. An increase in resources is predicted and reflected in the Object Class submissions.

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Objective (new):

Perform industrial engineering studies and analyses of existing in-service equipment/systems to determine ~~capabilities, limitations~~, degree of utilization, methods improvement and operational safety. This is an additional objective closely related to the equipment test, evaluation and maintenance objective under Imagery Services.

Accomplishments:

Because of the close relationship of one engineering technology or discipline to another and the nature of the test and evaluation function the Test and Evaluation Branch has already become involved in several projects akin to industrial engineering. The first phase of a building vibration analysis, an environmental study, has been completed and work will continue to determine cause and the effect upon the exploitation process and recommendations for corrective action. Some work has also been done in the field of industrial safety made necessary by a growing realization that the type of equipment, in use and proposed, must be reviewed from a safety standpoint. An equipment survey has been started to determine one element of light table use data based on a statistically valid, sampling of the equipment in daily operational use.

Requirements and Authorities:

This is an internally generated requirement based upon a gap in the knowledge on equipment/system acquisition and application process and in support of equipment/system management decisions. Evidence of need has been recognized from the lack of base-line information on the exploitation process, environmental effects, equipment use criteria, equipment safety and resource control. There is no current, recognized, assigned program generally described in the industrial engineering discipline. The nature of the proposed program is such that it is closely related to the equipment/system maintenance, test and evaluation program objective. The program would be designed to ensure methods improvement, cost reduction, industrial safety, effective utilization of in-service equipment and systems and eventually to lead to definitions of new equipment/system requirements.

Method of Approach:

Principles of industrial engineering including work flow, methods improvement, materials handling will be applied in studies of Center processes to be accomplished by an in-house staff supplemented by contractual resources. Policy and procedures to implement the program will be written in coordination with appropriate components. The functions initially will be assigned to the existing Test and Evaluation Branch to provide a foundation upon which to develop the capability. Milestones will be the completion of studies and recommendations resulting from the application of industrial engineering techniques. One of the first milestones would be to establish accountability and responsibility for the functions.

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Alternatives Considered:

Total contractual support is one of the alternatives considered and is practicable to a certain extent. In-house expertise would still be required in order to define the work and to provide technical contract monitorship. The ratio of in-house cost versus contract cost estimated at 3 to 1, favoring in-house support is also considered to be a factor. Another alternative would be to proceed with the gap unfilled. This would mean in actuality that some work will be done as in the past under the guise of other efforts with no real recognition or identification and no fixed responsibility. Some work will be done since industrial engineering is a necessity in productive organizations of the Center's scope. Recognition and full staffing requires management awareness and acknowledgement. The recommended alternative is to establish an in-house/contractual support mix.

Coordination:

This proposal will require management support from other NPIC elements for recognition of the resources required and with OL for personnel recruitment and administrative support and because of the natural interface that the program would have with equipment and property selection, procurement and inventory functions associated with logistics management.

Resources Required:

It is anticipated that trends in the exploitation processes such as the increasing use of advanced equipment and techniques, will lead to a staff requiring the resources reflected in Object Class detail in the 5 Year Plan.

TSSG/APSD-277/69
1 December 1969

MEMORANDUM FOR: Chief, Planning, Programming and Budgeting Staff, NPIC

THROUGH: Chief, Technical Services and Support Group, NPIC

SUBJECT: NPIC FY 72-76 Five Year Plan

1. Attached is the TSSG/APSD input to the NPIC FY 72-76 five year plan. The division is totally committed to the Imagery Analysis program element and objectives. However, since those objectives are of a general nature, it was found that APSD accomplishments and program plans could be better set forth by collating them into basic areas of concern, and designing specific objectives to cover them.

2. It is therefore recommended that the following objectives be added to the Imagery Analysis program element:

a. Develop analytical photogrammetric techniques to derive reliable dimensions from image measurements to insure maximum exploitation.

b. Develop and implement a microdensitometric capability to support photo-interpretation and imagery/systems evaluations.

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SUBJECT: NPIC FY 72-76 Five Year Plan

c. Provide continuous day-by-day liaison between NPIC and the various operational image collection components at the National level.

d. Provide guidance and assistance to those planners in the Community actively involved in acquiring the highest quality imagery from current and pending collection systems, and in the optimum reproductions of the products so derived.

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Chief, Applied Photo Science Division,
TSSG/NPIC

Attachment: a/s

Distribution:
Orig - Addressee, w/a
1 - NPIC/TSSG/APSD, w/a

ATTACHMENT to
TSSG/APSD-277/69

TSSG/Applied Photo Science Division's Contribution to the Imagery Analysis Program Element for NPIC FY 72-76 Five Year Plan

I. ACCOMPLISHMENTS

Following by area of concern are the APSD's accomplishments in Calendar year 1969:

A. Analytical Photogrammetry

In the past year, the APSD developed photogrammetric stereo math models for each of the current and pending acquisition systems - giving NPIC a first time capability to provide reliable dimensions via stereo mensuration and data reduction techniques. This work was devoted to APSD's objective of supporting the mensuration activities of photo-interpretation by developing analytical photogrammetric techniques to transform image measurements to reliable object dimensions. In addition, the APSD investigated and implemented techniques of error propagation which will enable the NPIC mensuration photogrammetrists to report computed dimensions with an associated degree of confidence. The division also actively provided technical assistance to support the development of some of the Center's more sophisticated mensuration equipment and to fulfill require-

SUBJECT: APSD Contribution to the Imagery Analysis Program Element for NPIC FY 72-76 Five Year Plan

ments of a sensitive nature from both the DDP/CIA and the DDI/OSR.

B. Microdensitometry

Inherent to the Center's technical maturity in the field of photo scientific exploitation of imagery is the need to provide it with state-of-the-art techniques for the exploitation, evaluation, and mensuration of system products, through the use of microdensitometry. The APSD has in the past year, investigated, supported and devised special techniques which utilize the accuracy of the microdensitometer to measure not only distances but density gradations, to provide accurate measurements of small objects on products of marginal quality. In anticipation that the Center will become more involved in the exploitation of such multi-layered products as [redacted] 25X1

25X1 [redacted] the division has monitored a contract to investigate [redacted] assessment concepts, 25X1 using microdensitometric techniques. The final report on this two-year study was completed in November of this year and is now being analyzed for its potential application to image interpretation and diagnostic evaluations.

SUBJECT: APSD Contribution to the Imagery Analysis Program Element for NPIC FY 72-76 Five Year Plan

The use of microdensitometry in the field of image manipulation has been closely followed. The Center has been in constant contact with the DDS&T/ORD in this area and has supplied them with raw microdensitometric data and technical assistance. The experience and training resulting from this contact will be a valuable asset to the Center in future months.

C. Initial Phase Handling Requirements

A major modification to a current collection system resulted in providing the Community with a double payload for every mission. In order to effectively reprogram targets to be acquired on the second half of these missions, the APSD was given the requirement to assess the cloud cover and film quality of every frame, during the initial phase handling of the product at the processing site. A technique to effectively respond to this task in the time required was successfully worked out and an expeditious dissemination of the results was accomplished. The product not only assists mission planners in economizing on film and in providing additional coverage of targets that could not have been programmed, but also assists the Center in its

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planning for the exploitation of the film. The successful implementation of this task has emphasized to planners of a future multiple payload system, the economy and necessity of having APSD personnel actively involved in the initial phase handling and evaluation of their product. The division has also participated in an exercise to determine the operational readiness of another processing facility to process and reproduce products from the more sophisticated current image collection systems. The results of their performance were favorable and the conclusions derived were directly influenced by the observations of the Center's initial phase handling team and an analysis by the division of the products subsequently received. This exercise will have a direct effect on how the products from a future multiple payload system will be processed and reproduced.

D. Product Specifications

Of basic importance to the Center is the need to adequately describe, and then effectively monitor, their specific requirements for film reproductions. This year for the first time since its inception, the Center, largely

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through the efforts of the APSD, has provided the Community with a comprehensive set of specifications expressly designed to provide the interpreter with the best possible product from each of the two major current acquisition systems. Procedures, techniques and avenues of communication have been established to the extent that these specifications will provide the base for further specifications on the less sophisticated systems. The same format and philosophy will also apply as new and exotic film products become available. The task of monitoring NPIC reproductions is presently being studied. With the volumes of material anticipated, it has become obvious that some selective sampling techniques will have to be established. Investigations along these lines are being pursued by the division.

E. Operational Support

Throughout the year, over each weekend and holiday the APSD has provided the Center with a continuing flow of operational information essential to the orderly and timely conduct of NPIC functional responsibilities. By maintaining this all hours uninterrupted liaison, primarily

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in relation to reconnaissance activities conducted or controlled by the NRO, the JCS/JRC and the OSA/CIA, the division has kept the Center continuously abreast of operational activities. In juxta-position to the acceptance of operational support, the division has provided a total of 15 hard copy Photographic Evaluation Reports (PERs) and approximately 80 cabled evaluation reports on system performance to these operations groups. To further provide intimate customer feedback to planners and manufacturers alike, the division participated in a total of 15 Performance Evaluation Team (PET) efforts performed on two of the major image collection systems. Experience shows that support to the operational components, in the Community, has invariably provided direct or indirect benefits to the Center. This division is currently involved in a study to determine why certain programmed targets are missed during acquisition by one of the most sophisticated "pointing" camera systems. Division analyses of the predicted vs. actual acquisitions of specific targets has resulted in assisting other NPIC components in refining the geodetic positions of many important targets and the

consequent reduction in the number of target misses experienced on these missions. The benefits to the Center of assured continued coverage of these targets is obvious. A further standing operational requirement concerns supporting the NRO in providing the Intelligence Community with PI oriented camera manuals. In the past year four manuals were produced in the division, each aimed toward supplying the PI with the knowledge he needs to fully exploit the products from these sophisticated systems.

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TSSG/APSD-277/69

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II. PROGRAM PLANS

Photo science and photogrammetry will play increasingly important roles in providing future Center procedures for fulfilling its responsibilities and requirements to the Community. Prior to the FY 72-76 time period these sciences will further mature to a position where their inputs will be a major influence on the quality of the product the Center receives and on the reliability and accuracy of the products the Center produces. FYs 72-76

[redacted] 25X1 NRO

products resulting from other aircraft and drone acquisitions. The preparation of these products to insure optimum interpretability and the reliability of measurements derived from them are two major responsibilities of the APSD. The methods to be used in resolving these commitments are constantly changing as is the emphasis placed on the means in which they are to be pursued. Following by objective are some of the major anticipated efforts that the APSD envisions will have an impact on the current workload and on its future personnel and equipment needs.

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A. Objectives in Analytical Photogrammetry

(1) To remain consistent with the NPIC objectives of obtaining maximum detail from imagery and of improving mensuration capabilities, the division will continue to develop photogrammetric math models for future acquisition systems. [redacted] 25X1 NRO

25X1 [redacted] The reliability of computed dimensions will soon become as significant as the computed values themselves, and the division anticipates continued efforts in this area. The division will also continue to develop techniques applicable to the solution of day-to-day mensuration problems. To this end it will work toward developing a multi-option capability of processing image measurements from any type of acquisition system, and will continue to develop analytical techniques in support of such NPIC mensuration instrumentation as the AP-3 and HPSC.

(2) Resources Required: With the possible exception of some minor consultant needs and a greater emphasis on training of personnel, the APSD does not

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envision any significant expenditure of money or the need for additional personnel in this area.

(3) Alternatives: The development of photogrammetric math models can be accomplished by external industrial contractors. The principal advantages of this procedure appear to be the utilization of the contractor's expertise and less commitment of NPIC personnel (photogrammetrists). However, proper performance by contractors first requires their education concerning the mensuration needs of NPIC, their particular mensuration equipment, and those camera systems whose products are, or will be exploited by the Center. Secondly, their performance must be monitored by NPIC personnel who would most logically be the photogrammetrists. Third, their performance is usually dedicated to specific systems which is fine as long as the systems continue to provide inputs or remain in existence with no changes. The major disadvantage of this procedure is that the application of NPIC photogrammetric talent and experience is either neglected or not fully exploited.

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Additionally, essentially the same amount of time would be spent by NPIC personnel in monitoring and implementing the contract as would be spent in developing the work in-house and further contracts would have to be let for maintenance of the models or for development of modified models. Since division photogrammetrists have demonstrated a capability to produce a quantity of quality math models with a rapid response time, the alternative of contracting such work does not appear to be in the best interests of NPIC.

B. Objectives in Microdensitometry

(1) Following the assumption that the Center should pursue pertinent and potentially profitable techniques for the exploitation, evaluation and mensuration of system products, the division anticipates continued expansion of its microdensitometric capability. Should procedures presently being investigated prove useful in analyzing such new system products as

25X1

[redacted] and also be of assistance in image/system evaluations, increasingly sophisticated

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requirements can be envisioned. As an example, under the Imagery Analysis portion of the Center R&D five year plan, is a major contract studying Digital Image Manipulation (DIM). Should such an avenue prove its utility in a production environment, the APSD will become the recipient of a digital image manipulation facility by FY 73. Since the input device(s) are microdensitometers, this responsibility logically falls under the division's microdensitometry objectives.

(2) Resources Required: Assuming that the APSD will acquire a digital image manipulation facility in FY 73, site preparation for an environmentally-controlled clean room of at least 20' X 20' should be initiated in FY 72. Digital manipulation of imagery requires a considerable amount of continuous software programming and the need for a dedicated scientific computer with a vast amount of storage capability. The APSD will also need contractual assistance in programming the software. Along with this will be the need for at least two qualified ~~technicians~~ analysts perhaps at

the GS-11/12 grades who have a knowledge of basic electronics and are dedicated to the exploitation of products through the use of microdensitometry. The need for a dedicated computer operator expressly involved in DIM is also evident.

(3) Alternatives: The only alternative to the development of a production-oriented microdensitometry capability is not to follow such a course. The advantage of this alternative is that no additional NPIC personnel or funds would be committed. One disadvantage would be that evaluations of imagery and system performance would have to be based entirely on the subjective rather than objective data. A further disadvantage would be the fact that the Center would fall behind the rest of the Community in the fields of objective system analyses, image manipulation capabilities and multi-layer films assessments, all of significant importance to the proper exploitation of products by the Center. An alternative to acquiring a computer operator would be to

contract out all microdensitometric software programming. However, since the technology of DIM is not static, most programs would be obsolete before division personnel could be trained to understand and use them.

C. Objectives in Initial Phase Handling

(1) Assuming that the [redacted] 25X1 NRO are launched as presently scheduled, the APSD will need to recruit for the provision of at least an 8 man permanent contingent at the major processing site by FY 72. These personnel will be primarily involved in the initial phase handling of [redacted] 25X1 NRO material, in monitoring the reproductions to be provided the Center and Community and in the evaluation of the [redacted] 25X1 NRO performance, to assist in reprogramming poorly covered targets of concern. They will also be available for any crisis management problem that may arise which would benefit by their quickly providing additional reproductions, evaluations, etc. to the Community.

(2) Resources Required: Unless the Community decides on some exotic means of film reproduction,

(e.g. film chips) the majority of the equipment needed by the APSD personnel may be standard off-the-shelf items such as rear projection viewers and motorized wind light tables. Augmentation of the permanent contingent will be necessary during the initial phase handling operation on each payload. This will require additional expenditures in travel. It is envisioned that as an interim measure in lieu of a permanent contingent or perhaps as an alternative until the

25X1 NRO [redacted] is consistently operational, a total of 12 to 14 personnel will be traveling to the site for

25X1 NRO [redacted] - necessitating the need for a proprietary aircraft. Barring the cancellation of [redacted] 25X1 NRO present and anticipated requirements demand that at least 8 additional photo technologists be added to APSD ranks by FY 72. The division assumes that any automatic target readout will be conducted at the Center and by other than APSD personnel rather than at the processing site; therefore, no provision for equipment along these lines are contained in the APSD five year plan.

(3) Alternatives: A special report was provided in August 1969 to the NPIC/TSSG/PPS concerning alternatives to this commitment (Attachment 2 to [redacted] 25X1 6 Aug 69).

D. Objectives in Product Specifications

(1) Now that NPIC has the vehicle for providing its reproduction specifications to the Community, it not only has the responsibility for updating them but for monitoring each reproduction as it arrives at the Center. Continuing advances in reproduction techniques can be envisioned as new products become available and as NPIC exploitation procedures become more sophisticated. By FY 72 it is expected that target oriented reproductions of high priority targets will become a conventional item in NPIC film reproduction requirements. This becomes especially pertinent as new multi-layered emulsions such as [redacted] 25X1

25X1 [redacted] are developed and become operational.

The criteria for all reproductions must be provided to the processing site and the need to be fully knowledge able of processes available which can provide maximum

information to the PI must be fully understood. These products will demand that additional equipment be procured by this division. APSD can also envision that several differing methods of enhancing imagery through the use of special emulsions, or printing and processing techniques will be available and can be provided in-house on a production basis by FY 73. This assumes that the original film will be available to NPIC.

(2) Resources Required: In order to provide the PI with an image enhancement capability, the division will have need for a photographic laboratory and darkroom facilities by FY 72. Such equipment needs as automatic scanning densitometers, photomicrographs, spectraphotometers and microtomes can be foreseen in the FY 73-76 time periods.

(3) Alternatives: Alternatives to this plan would be to consider either the TSSG Exploratory Laboratory or the PSG Photographic Laboratory as a likely place for conducting such services. However, the TSSG Exploratory Laboratory is strictly research-oriented and not designed to accommodate production-oriented requirements. The

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PSG Photographic Laboratory is strictly a production-oriented lab not specifically designed for conducting technical experiments in photo science. The APSD has the photo scientists, the know-how, and the contacts to provide this type of service to the Community.

E. Objectives in Operational Support

(1) In consonance with the added complexity of pending systems and the planned volume of material which could enundate the Center, the APSD plans to provide expanded liaison with organizations responsible for the direction or control over image collection activities at the National Level. The division anticipates a need to participate to a greater extent in Community planning and discussions concerning the employment of operational systems. Additionally, it plans more frequent liaison visits to a wider range of external organizations and offices, to include operational sites and project facilities. Such operational activities should establish a comprehensive data base of operational information that can be reliably used by the Center in its day-to-day exploitation planning. So that this information can be

readily available and in a sufficiently flexible format, the APSD plans to develop, in participation with PSG/AID, a computerized data base and retrieval system for operational statistics concerning all current image collection operations, and products derived from them. Provision will be made for the information to be extracted in a variety of periodic printouts and summaries. This plan can be accomplished in-house with a minimum amount of equipment or contractual time. The division plans to continue its efforts in evaluating products from pending and operational systems, attending and hosting Performance Evaluation Team meetings, and in providing the interface between the subjective PI and the objectively-oriented system planners and engineers.

(2) Resources needed: Depending on the needs of Center management and on the complexity of other unforeseen systems, a need for one or two more liaison officers of the GS-11/12 calibre can be anticipated. Resources needed to continue the system evaluation efforts will be along the line of off-the-shelf viewing tables, microscopes

and stereoscopes. It is hoped that the additional 8 man contingent at the processing site will be able to provide some assistance in evaluations and special studies, between mission payloads.

(3) Alternatives: An alternative to this plan would be to continue along the same lines as we have in the past, relying on close personal contact and informally structured liaison to accomplish this job. However, this does not allow for the added complexity of new systems or the flood of additional information presently available to the Center. To consider that operational liaison can remain static will serve only to further isolate the Center from the rest of the Community.